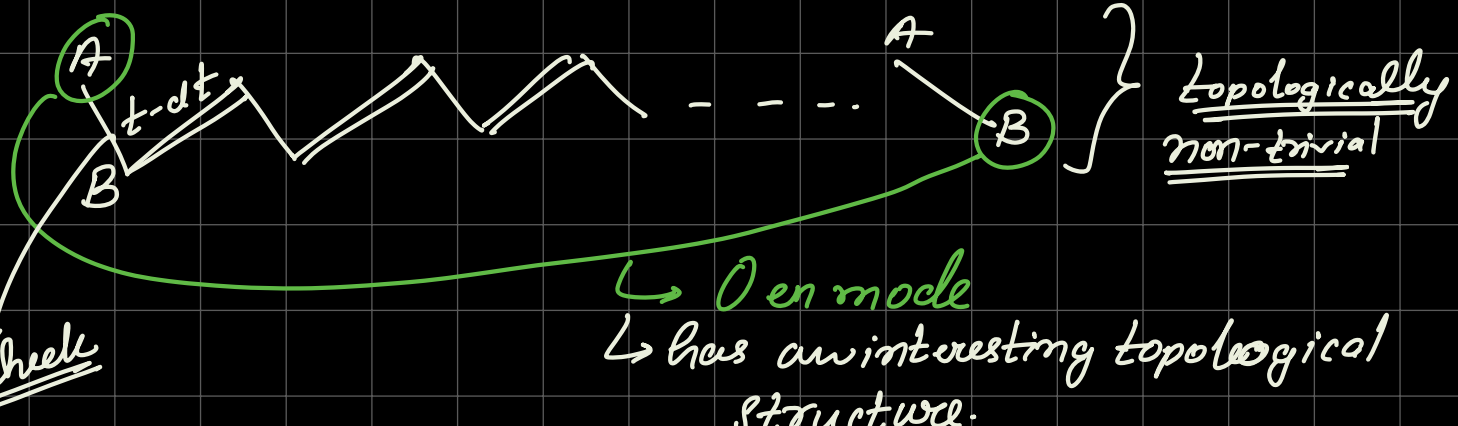
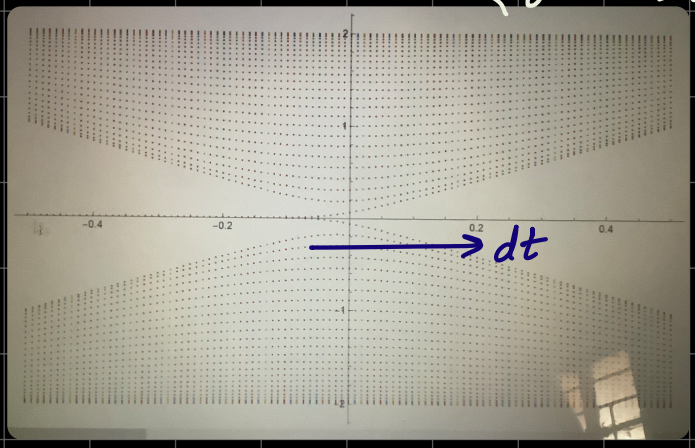
SSH model :- wrote it in notebook



sign of dt ⟶ > 0 → trivial
< 0 → non-trivial



now we do tight binding
↳ calculate tight binding

QHall physics again & again (and somebody kill me!)

L.L. in bulk

at boundaries we find that LL cuts the fermi energy → modes are gapless.

Hall conductivity ∝ Chern # (without invoking boundaries at all)

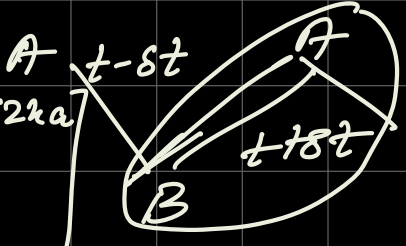
(σ_{xy}) or (S_{xy}) ???

→ even for insulator, we have a anomalous velocity

even though

E_F doesn't have a state around it, the Berry curvature implies a anomalous vel.

$$\mathcal{H}_{SSH}(\vec{k}) = \begin{bmatrix} 0 & (t+\delta t) + (t-\delta t)e^{-i2ka} \\ (t+\delta t) + (t-\delta t)e^{i2ka} & 0 \end{bmatrix}$$



or

$$\begin{bmatrix} 0 & (t+\delta t)e^{-ika} + (t-\delta t)e^{ika} \\ (t+\delta t)e^{-ika} + (t-\delta t)e^{ika} & 0 \end{bmatrix} = \mathcal{H}$$

$$\mathcal{H} = 2t\cos ka\,\sigma_x - 2\delta t \sin ka\,\sigma_y$$

$$v\left[p_x\sigma_x + p_y\sigma_y\right]$$

→ will reduce to Dirac Hamiltonian around $k = \frac{\pi}{a}$

@Shen

$\delta t > 0 \rightarrow B\beta = 0$

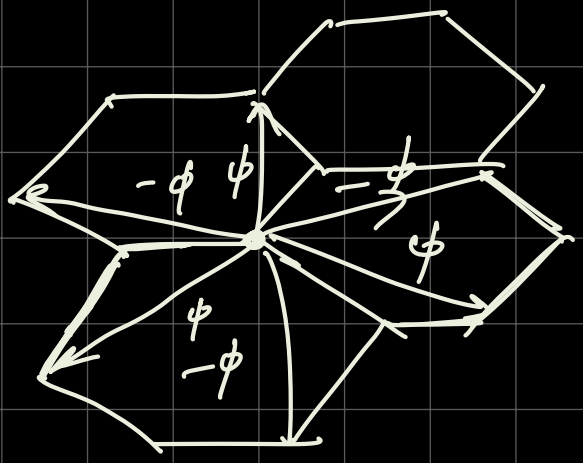
$\delta t < 0 \rightarrow B\beta \neq 0$

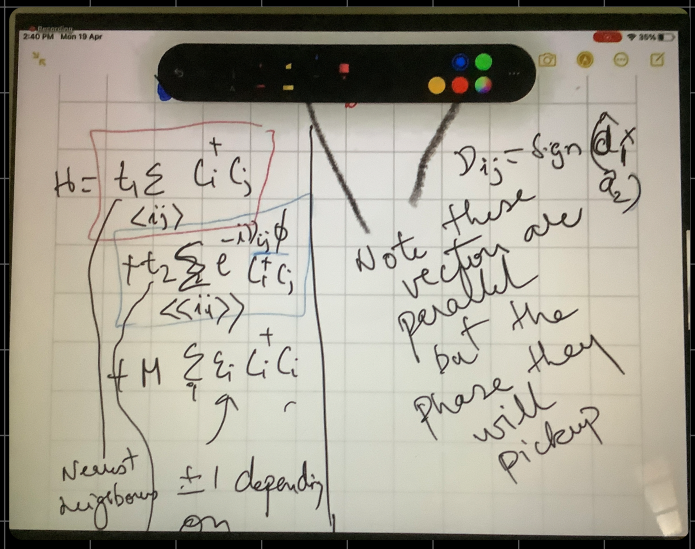
Haldane Model

- 1st effort to realise ϕ_{Hall} without $\vec{B} \neq 0$

NN → has a phase → that oscillates b/w

↳ net phase in unit cell is 0. ⇒

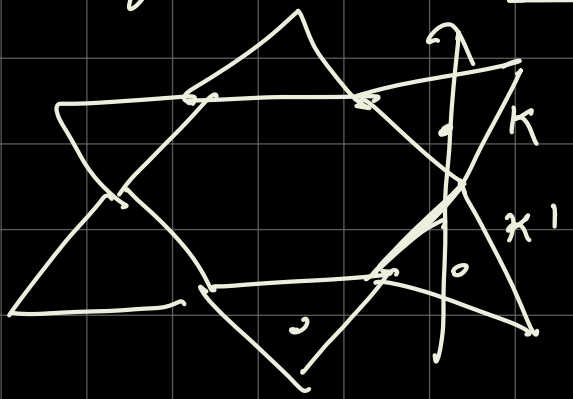




$$M \sum_i E_i c_i^\dagger c_i$$

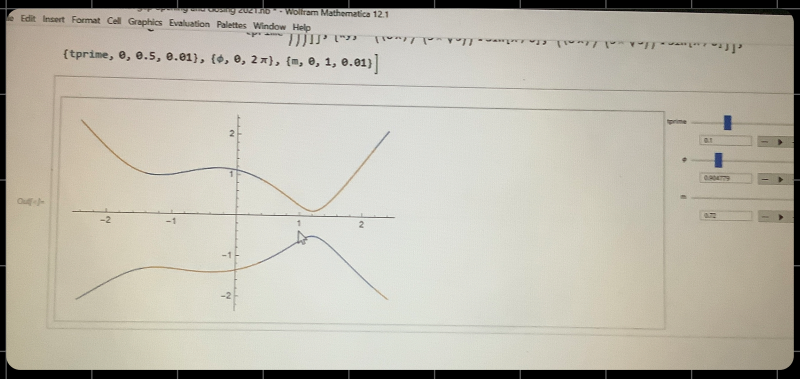
("Mathematica")

⇒ diff mass terms = Semenoff term



KK' connection

inversion symm broken → one valley having lower energy than other.



Gap opening & Gap closing

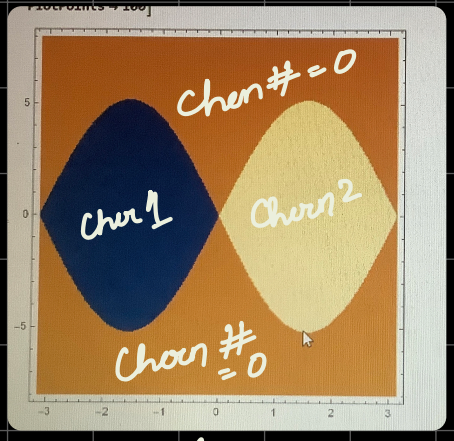
↳ valley → gap closing & opening leads to transition b/w topo non to topo triv.

BZ →

↳ get lower eff hamiltonian

↳ Chern # ⇒ well known formula

Chern # $\neq 0$ ⟶ for graphen = 0



m/st

ϕ

Chern # +1 → one edge state

" " +2 → " " " "

next class

↳ edge modes will exist for a boundary mode.